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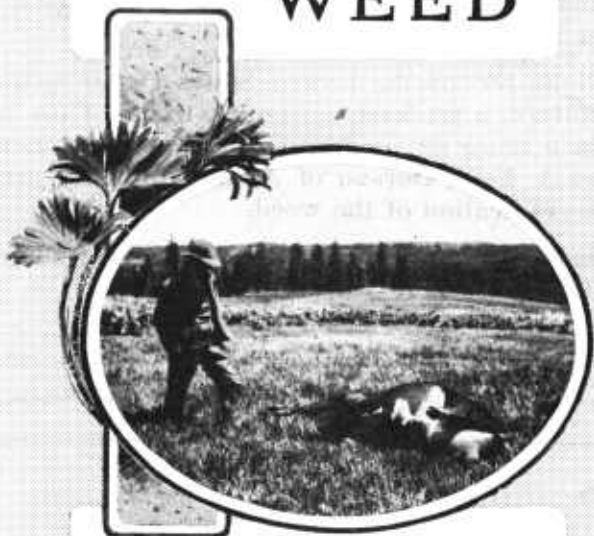
U. S. DEPARTMENT OF AGRICULTURE

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LARKSPUR or POISON WEED



STOCKMEN who graze cattle on the mountain ranges of the western United States suffer heavy losses from larkspur poisoning. Careful and long-continued investigation under range conditions has shown clearly under what conditions these deaths occur and has shown also that by sufficient care most of the losses can be avoided.

This bulletin, in a brief form, gives the facts and the measures which should be taken to reduce the losses.

Bulletin 365 of the United States Department of Agriculture, a professional paper, treats of the subject in a more detailed and technical manner, and Leaflet A. I. 34, Bureau of Animal Industry, treats of the eradication of the weed.

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LARKSPUR OR "POISON WEED"

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LOSSES FROM LARKSPUR POISONING

THE RECORDED LOSSES from larkspur poisoning have been very largely in the cattle ranges of the western United States and Canada, although many instances of poisoning are known in the Eastern States. In the cattle ranges of the West probably no other poisonous plants, with the exception of the loco weed, have caused such heavy losses to the stockmen.

It is difficult to estimate with any degree of accuracy the extent of these losses. A conservative estimate based on reports from a large number of ranges indicates that the annual loss is from 3 to 5 per cent. A great many of the stockmen who have reported upon the subject have given an estimate of 5 per cent. Specific cases are known in which from 20 to 50 cattle out of a single herd have died within a few hours, and in other instances individual stockmen have lost as many as 200 head in a season. These losses were attributed to larkspur, since they occurred on ranges where these plants are abundant. In most cases, however, definite evidence that the larkspurs were the cause of the losses was wanting until it was proved conclusively by the extended investigations of the United States Department of Agriculture. Accounts of losses have come from practically all of the cattle ranges in the mountains from the Rocky Mountains westward. These ranges at the present time are very largely in the domain of the national forests and a map of the national forests would give a fair idea of the distribution of most of the larkspur poisoning.

Some losses, also, have occurred in the Plains region and in the Eastern States.

LARKSPURS POISONING LIVESTOCK IN THE UNITED STATES

Two general groups of larkspurs are found on the western ranges—the tall and the low larkspurs. The tall larkspurs grow in great abundance in the gulches and canyons of the more elevated ranges, while the low larkspurs grow in similar regions but upon the open hills, in drier localities, and extend to somewhat lower altitudes.

In the regions where the plants are abundant they are commonly known as “poison,” “poison weed,” or “cow poison.” In New Mexico the tall larkspurs are known as “peco.”



FIG. 1.—Tall larkspur (*Delphinium barbeyi* Huth) before blossoming. This is the most dangerous stage of the plant

TALL LARKSPUR

In the mountains of Colorado the tall larkspur is represented by the species *Delphinium barbeyi* Huth, which grows from an altitude of about 8,000 feet to very near the timber line. When fully grown it is from 3 to 7 feet in height, with a long, woody root, and has violet-blue flowers. The plant begins growth early in the spring, and in the region of the experiment station at Mount Carbon was from 1 to 2 feet high in May, forming bunches much more prominent than the grass and doubtless attractive to grazing animals. Figure 1 shows the plant as it appears in May before blossoming. It blos-

soms in July, and the seeds are formed in August, when it commences to dry up, but does not entirely disappear until broken down by the winter snows. This species is found in the mountains of Wyoming, Montana, and Utah, as well as in those of Colorado.

The common species found in Montana is *Delphinium cucullatum* A. Nels. Figure 2 shows the form of the leaf, flower, and seed pod of this species. It is not so large as *D. barbeyi*, and the flowers present a grayish-blue appearance, but the general habit of the plant resembles that of the tall larkspur of Colorado. In the other mountain ranges of the West the species of tall larkspur resemble very closely the two mentioned.



FIG. 2.—Tall larkspur (*Delphinium cucullatum*)

In the Northwestern States the common tall larkspur is *D. trollii-folium* Gray.

It is not difficult to distinguish the tall larkspur after it blossoms, as no other plant in similar localities has a flower at all resembling it. In the early stages, however, like that represented in Figure 1, it is easily confounded with geranium and aconite (monkshood), both of which frequently grow in great abundance in the same places. Figure 3 shows a plant of geranium (*Geranium viscosissimum* F. and N.) which may be considered a type of the species of geranium common in the mountain ranges. The leaves of this geranium resemble those of the tall larkspur. The plant, however, has a very differ-

ent habit and after blossoming is readily distinguished from the larkspur.

It is more difficult to distinguish the plant of the aconite, an illustration of which is given in Figure 4. The plant shown, *Aconitum columbianum* Nutt., may be considered as typical of the aconites found in the mountain regions. It has a flower easily distinguished

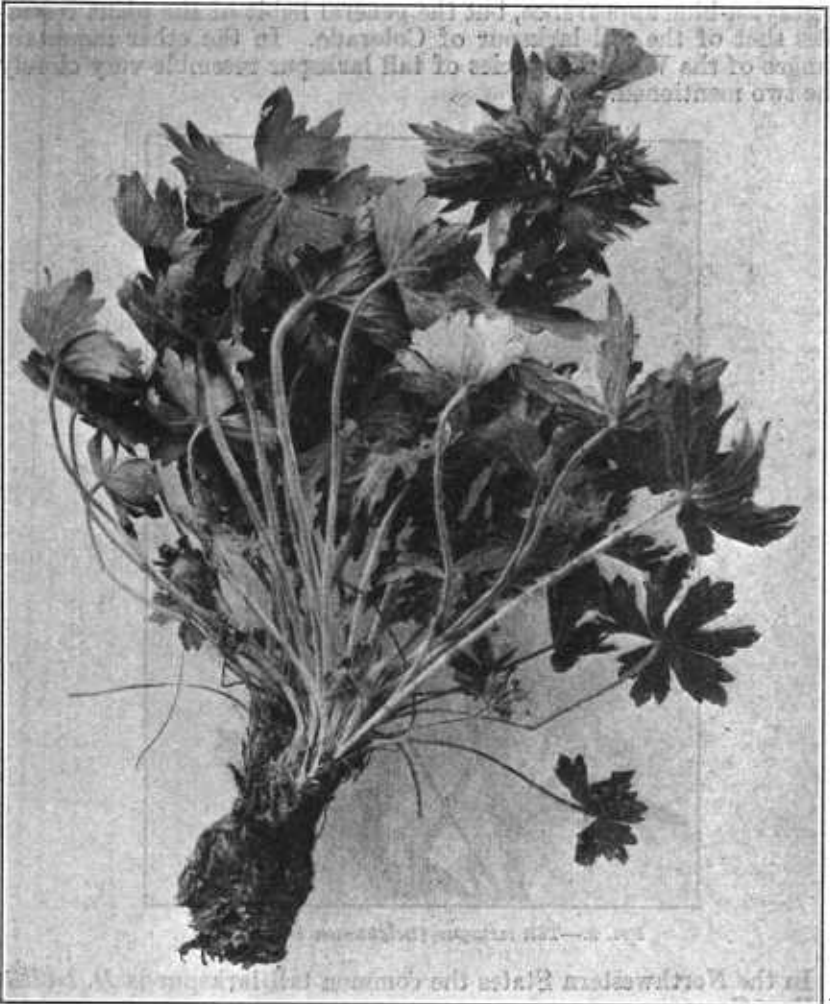


FIG. 3.—Geranium of mountain regions (*Geranium viscosissimum* F. and N.)

by its form from that of the larkspur, as will be seen by comparing Figures 2, 4, and 5. The color of the aconite flower is commonly deep blue, but it varies through shades of violet, blue, and purple, and in some varieties is greenish white. The leaves resemble those of the larkspur, although they are more closely attached to the stem. The stem of the tall larkspur is hollow, while that of the aconite is pithy. The root of the aconite is short and bulblike instead of long

and woody, as in the tall larkspur. Aconite frequently grows in considerable abundance in the midst of clumps of the tall larkspur.

LOW LARKSPUR

Delphinium menziesii D. C. (fig. 5) may be taken as a type of the low larkspurs. This species grows in considerable abundance in Wyoming, Colorado, New Mexico, and Utah; and this or a closely



FIG. 4.—Aconite (*Aconitum columbianum* Nutt.)

allied species is found also in California and Oregon. It is found at altitudes of from 4,000 to 10,000 feet on open hillsides and in parks, sometimes covering large areas. The root is short and tuberous and the plant does not usually exceed a foot in height. The blossoms, which are violet blue, appear in May; and seeds are formed in the latter part of June, after which the plant dies and disappears. The species illustrated is rarely found after the first of July.

In the States north of Colorado is found a similar larkspur, known as *Delphinium bicolor* Nutt., which resembles *D. menziesii* and has

the same general habit of life. The root, however, is long and fibrous, and the blossoms are somewhat larger. It is the most beautiful of the American larkspurs.

In the plains east of the Rocky Mountains is found a white-flowered larkspur, *Delphinium virescens* Nutt., shown in Figure 6.



FIG. 5.—Low larkspur (*Delphinium menziesii* D. C.)

It does not ordinarily grow in great abundance, but in some years the plant occurs in sufficient numbers to produce losses, and there are well-authenticated accounts of considerable losses to individual owners. In the Eastern States the species reported to cause poisoning of cattle is "dwarf larkspur," *D. tricorné* Michx.; this plant,

commonly called "stagger weed," is from 1 to 3 feet in height and has tuberous roots in clusters. This has caused losses of cattle in the mountains of Virginia and West Virginia, and in neighboring States.

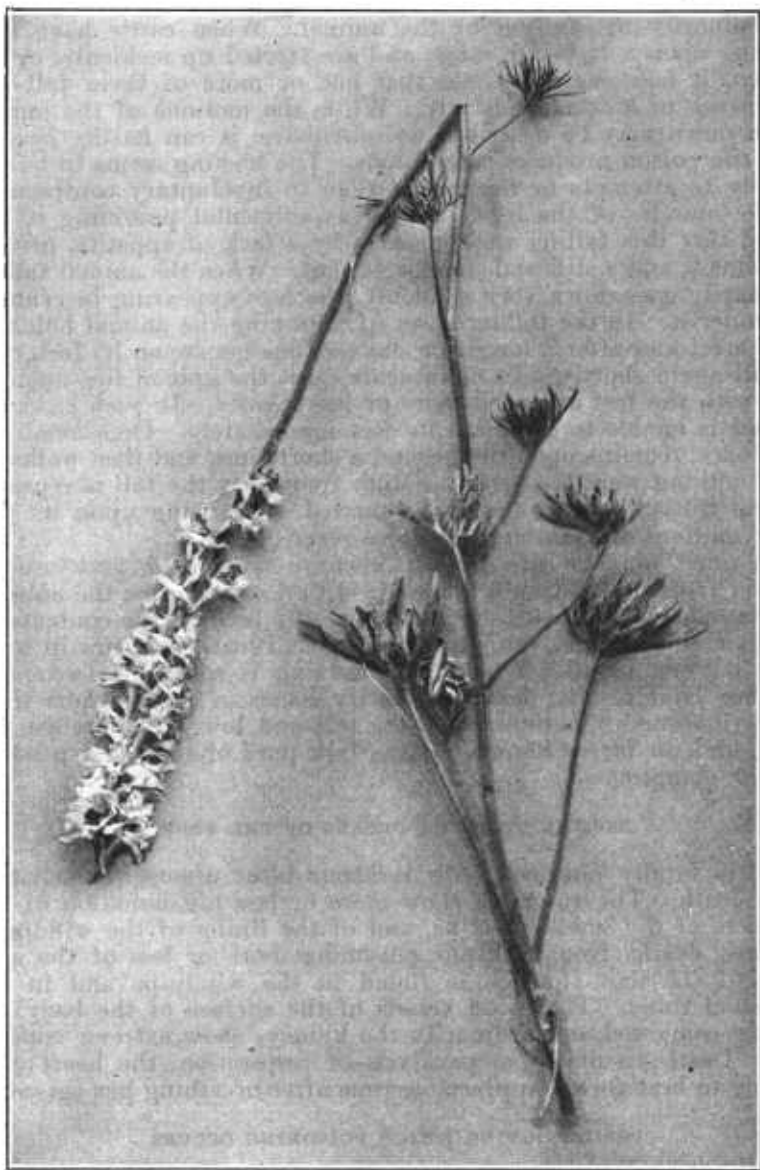


FIG. 6.—The plains larkspur (*Delphinium virescens* Nutt.)

There is in the Pacific States a red-flowered larkspur, *D. andersoni* Gray, which, like the other species, is poisonous, but does not grow in sufficient abundance to cause heavy losses.

LARKSPUR POISONING

SYMPTOMS

The first symptom of larkspur poisoning, as noticed on the range, is ordinarily the falling of the animal. When cattle have been feeding upon a larkspur range and are started up suddenly, or are driven, it happens sometimes that one or more of them fall and commence to kick convulsively. While the motions of the animal when down may be described as convulsive, it can hardly be said that the poison produces convulsions. The kicking seems to be due largely to attempts to rise rather than to involuntary contractions of the muscles of the legs. In the experimental poisoning it was found that this falling was preceded by a lack of appetite, general uneasiness, and a stiff and staggering gait. When the animal falls it ordinarily goes down very suddenly, the legs appearing to crumble up under it. In the lighter cases of poisoning the animal holds its head erect and after a longer or shorter time gets upon its feet, only to fall again shortly. In more acute cases the animal lies upon its side with the feet extended more or less rigidly. In such cases the animal is unable to get upon its feet immediately. Occasionally it falls once, remains upon the ground a short time, and then walks off as if nothing were the matter. More frequently the fall is repeated several times. If the animal is hurried after being upon its feet the symptoms of poisoning are more severe.

Poisoned animals are almost always constipated and usually recover if that condition is relieved. In all severe cases the animals are nauseated and death frequently results because the contents of the first stomach get into the windpipe. Bloating occurs in some cases but not in all. When the poisoning is sufficiently severe to produce fatal results, death ordinarily comes in a very short time. The symptoms of poisoning by the tall and low larkspurs are the same, and, so far as known, all the larkspurs of the West produce similar symptoms.

EFFECTS UPON THE ORGANS OF THE BODY

Cattle fatally poisoned with larkspur bloat almost immediately after death. The autopsies show more or less inflammation of the stomach, of the small intestine, and of the lining of the windpipe. In most deaths from larkspur poisoning more or less of the contents of the first stomach is found in the windpipe and in the bronchial tubes. The blood vessels of the surface of the body are greatly congested and ordinarily the kidneys show extreme congestion. Death results from paralysis of respiration, the heart continuing to beat for an appreciable time after breathing has ceased.

PERIOD DURING WHICH POISONING OCCURS

The low larkspur, as has been stated, is poisonous during its whole life, but the plant disappears the last of June or early in July. Poisoning from eating it occurs, therefore, only in the months of May and June. The tall larkspurs grow through the entire season, and after maturity the leaves gradually lose their poisonous properties. The seeds are more poisonous than the leaves and occasionally

cause death to cattle late in the season. The loss from eating seeds, however, is very small.

Inasmuch as the tall larkspur plants are particularly attractive to animals before the blossoms are formed, it follows that the most dangerous period of the tall larkspur corresponds very closely to that of the low larkspur, the larger number of cases of poisoning occurring in the months of May and June. In the mountains of Colorado some animals may be poisoned in July, but such cases are comparatively rare, and after the middle or last of August cattle eat the leaves of the tall larkspur with considerable eagerness and with no harm whatever.

In some localities like the Sierras, where the snow remains until late in the summer, the growth of the larkspur is delayed and the plants may not reach maturity until fall. Under such circumstances larkspur poisoning may occur very late in the season.

Most of the reported losses by the dwarf larkspur of the East have occurred in the spring months—March, April, and May.

During the season when poisoning occurs apparently all parts of the plants above the ground are poisonous. Cattle do not eat the roots of the tall larkspur, as they can not get at them. Contrary to the common belief of cattlemen, very few of the roots of the low larkspur are ever eaten by cattle, and the danger is not from the roots but from the parts of the plant above ground.

QUANTITY OF LARKSPUR NECESSARY TO POISON

Small quantities of the larkspurs can be eaten with impunity. Experimental work shows that an animal must eat about 3 per cent of its weight before being affected, and that in an average case it has eaten a larger quantity.

HORSES NOT AFFECTED ON THE OPEN RANGE

Experimental work showed that horses are poisoned by larkspur if they eat a considerable quantity. On the open range, however, it appears that horses never eat enough of the plant to produce any ill effect, so that they can be grazed with impunity upon ranges which would be fatal to cattle.

SHEEP NOT SUSCEPTIBLE

Careful and extended experiments upon the tall and low larkspurs growing about the Mount Carbon experiment station, in Colorado, showed conclusively that sheep can graze upon the plants without any harm. Corral feeding experiments showed that sheep can eat very large quantities of larkspur not only without harm but with apparent benefit. The experimental work at the Greycliff station, in Montana, corroborated that in Colorado, and there is every reason to believe that sheep are never injured by feeding upon larkspur.

PREVENTION

It is, of course, best, if possible, to avoid larkspur poisoning by handling stock so that they will not get at the plants in any quantity. Cattle can eat considerable quantities without harm, but it is

always dangerous to permit them to graze freely upon a larkspur area. This has been recognized by the stockmen on some of the ranges, who by keeping their cattle from the infested areas until about the first of July, prevent losses from low larkspur and most of the losses from the tall larkspur. This is sometimes done by riders. Where ranges are under the supervision of competent herdsmen much can be accomplished in the way of prevention.

In some cases, when limited areas are particularly infested with the plants, it may be desirable to fence them in and keep the cattle out.

"Drift fences" to keep the cattle below the high larkspur-infested ranges are used successfully in some localities. It should be remembered that when such fences are used it is safe to admit the cattle after the larkspurs have matured. No definite date can be given when the plant ceases to be injurious, because its maturity varies with the locality and the season. Careful examination should be made before the cattle are admitted. If the plants generally have passed the flowering period and are in seed, the range may be considered as safe. In most localities, under ordinary conditions, larkspurs may be considered harmless after September 1.

TREATMENT OF POISONED ANIMALS

When cattle are grazing freely upon a range containing larkspurs and are not immediately under the supervision of riders, deaths from larkspur poisoning can not be avoided. If, however, the poisoning occurs, as frequently happens, while animals are being driven from one range to another and are under the control of riders, it is sometimes possible to apply remedies that will aid recovery. Many of the cases in which poisoning is not severe will recover if care is taken to turn the animal, after it falls, so that the head will be higher than the rest of the body, and to see that it is not further disturbed. Any attempt to get the animal upon its feet or drive it rapidly is almost certain to be followed by fatal consequences. If the animal bloats badly it should be relieved by paunching—that is, by thrusting a trocar into the first stomach in the manner practiced by many stockmen in the West. When a trocar is not available a knife may be used, holding the cut open until the gas has escaped. Knife wounds, however, do not heal so readily as those made by the trocar. It is not clear that bleeding produces any good effects. The use of drenches of potassium permanganate, which is recommended in many veterinary manuals and other publications, has been found to be of no value.

In the station work it was found, in all cases, that beneficial results were obtained by using a subcutaneous injection of the following formula:

Physostigmin salicylate.....	1 grain.
Pilocarpin hydrochloride.....	2 grains.
Strychnine sulphate.....	½ grain.

This formula applies to an animal weighing 500 or 600 pounds. For a large steer or cow of 1,000 pounds or more the dose should be twice that given in the formula. These materials can be obtained from any dealer in drugs. The physostigmin salicylate and pilo-

carpin hydrochloride are furnished in veterinary hypodermic tablets, each containing one-half grain of physostigmin salicylate and 1 grain of pilocarpin hydrochloride. The strychnine sulphate can be obtained in tablets each containing one-half grain. They dissolve readily, and it is well to have two or three doses ready in small homeopathic bottles. For yearlings one should use two of the physostigmin-pilocarpin tablets and one of the half-grain strychnine tablets dissolved in water enough to fill one-third of an 8-dram homeopathic bottle; for full-grown cattle four of the physostigmin-pilocarpin tablets and two of the strychnine tablets, dissolved in an 8-dram bottle two-thirds full of water, should be used.

It is best to use an all-metal hypodermic syringe, which can be easily cleaned by boiling. The form which has been found most useful for the field is that known as the Quitman syringe. In this the needles are carried in the hollow piston, and a case is therefore unnecessary. The syringe should be of the 10-centimeter size, which holds one-third of an 8-dram bottle of water, so that the remedy can be given to yearlings in a single dose, while for mature cattle the syringe must be used twice. The needle is most conveniently inserted into the shoulder.

Stockmen are accustomed to the use of a hypodermic syringe, and if they are willing to try the remedy can without doubt save the lives of most of the animals poisoned during drives or round-ups. This remedy relieves constipation and stimulates respiration.

If it were possible to insure free action of the bowels before cattle are driven over a "poison area," probably most of the poisoning would be prevented.

ERADICATION OF LARKSPUR

The importance of the subject of larkspur poisoning naturally raises the question of the possibility of ridding the range of the plant. The plants grow so widely and abundantly that anything like complete eradication is impossible. Most of the cases of poisoning, however, occur where the plant grows in thick patches. Such patches are frequently found in gulches or box canyons into which cattle are likely to drift and remain until they eat enough of the larkspur to produce illness or death. In such places it is entirely feasible and economically possible to dig out the plants. It is desirable to destroy all the plants in such an area, but as an animal must eat about 3 per cent of its weight before being seriously poisoned, even an incomplete piece of work may be effective. Inasmuch as many of the shoots from the old roots are somewhat late in starting, the best time for digging the plant, if it is desired to do a thorough piece of work, is when most of the plants are in blossom. Some of the tall larkspurs have short roots and can be pulled. Most of them, however, have long, fibrous roots; in such cases the roots need not be removed entirely, but should be cut off deep enough to prevent further growth. This has been found, by experiment, to be from 6 to 8 inches below the surface. It is best to cut fully 8 inches below the surface, as this will insure that there will be no further growth. Care should be taken that the plants cut out should not be left where cattle can get them, for not only are the dried plants poisonous, but also cattle

sometimes greedily eat them in that condition. They should either be scattered so widely that the animals can not get any considerable quantity, or better, they should be piled and burned.

HORSES AND SHEEP ON LARKSPUR RANGES

From what has been said it is evident that ranges which are particularly harmful to cattle may be used with impunity for the pasturage of horses or sheep. It is suggested that certain ranges where the losses of cattle have been extremely heavy may be used profitably as sheep ranges.

On some ranges, especially those infested with low larkspur, it is possible, by grazing sheep before the cattle are turned in, to destroy enough of the larkspur to make the range safe. This does not succeed so well with the tall larkspurs, however, as the sheep do not clear out these plants so completely. If cattle and sheep are under the same ownership, and the sheep are close herded upon the larkspur for a short period, a material reduction in the larkspur losses may result.

SUMMARY

The larkspurs which grow in abundance on all the mountain ranges of the Western States, and to a less extent in the East, cause greater losses of cattle than any other poisonous plants except the locoes.

Horses and sheep are not injured by grazing on larkspur areas.

Most of the losses occur early in the season, but in areas where the snows remain late cases may occur late in the summer or even in the fall.

Poisoning may be prevented largely by keeping cattle away from the poison areas until the plant has matured; this may be done by riders or by the use of "drift fences."

Larkspur may be eradicated successfully in places where it grows in masses, into which cattle are likely to drift. In eradication, from 6 to 8 inches of the root should be removed, and the cattle prevented from eating the dried plant.

Cattle poisoned by larkspur should be kept as quiet as possible and turned with heads uphill; they should be paunched if bloating occurs; should not be bled; and in most cases may be saved by a subcutaneous injection of the formula given on page 10.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

October 3, 1929

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